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RECENT ENGLISH PATENTS FOR PAVING WITH WOOD.

A late number of the London Journal contains no less than seven patents for paving, and all of them referring to the use of wood. Nothing can better exemplify the misplaced ingenuity of men having an excess of contrivance in their mental organization, than the consideration of some of these patents. Without pretending to enter into all the minutiæ of these papers, which would require numerous cuts, we propose to give a general idea of them and in some places introducing along with the description the remarks of the editor of the London Journal.

The invention of H. S. M. Vandeleur consists "in forming or shaping two surfaces of each block to angular figures; The angles of different blocks being produced by radial lines from a point distant from under the side of the surface of the road or other paved way; such lines not running from the bottom to the top of the blocks, but only running partly up the block; the part of the side surface being produced by radiating lines from a point above, and the lower side surfaces from a point situated below the surface of the road or way.

It is manifest that the blocks cut in the manner directed will vary in form and while the central one resembles a prism the outside ones will have such an acute salient and reentrant angle as can scarcely be executed by common instruments, while the waste of material will amount to nearly one half. The plan then, however, ingenious can never be applied in ordinary cases. Another and far better method of fastening proposed by the same patentee consists in the employment of rectangular blocks with notches or grooves cut out of their corners, midway between the upper and lower surface of the piece, and intended to receive a small tye block. The consequence is that four blocks are thus secured by one tye and each block having four tyes it becomes impossible to depress any one block below the general surface. The last contrivance appears to be one of the simplest we

have seen, involving little expense in sawing and answering a good purpose.

It may here be remarked that a general feature in all these patents is the support furnished by keying the blocks, and the necessity for this is owing to the oozy substratum of the streets in many parts of London.

The invention of Daniel Ramee, as far as relates to paving alone, has reference not to the material or its shape, but to the binding together the blocks whether of wood or stone. This is done by means of frames made of bars of iron strongly bolted together by wedges which are forced in tight when the frame is filled with stones. A modification of this consists in the use of masses formed by fastening by straps and wedges four or more small blocks. Some times when the iron framing is used, the blocks of stone contained therein are tightened by wedge-formed border stones, which being forced down among the other blocks, press them tightly and closely together. It is not necessary to make comments upon this invention as it is too expensive to be used, except in certain cases to a very small extent.

The contrivance of John Browne is for the same purpose as the last. The frame work consists of iron ribs, having the required curve of the road and on these the blocks are placed. The frames are fastened together so as to prevent inequality in the surface of the road.

The next patent on the list is that of Robert Carey. The claim is for "constructing blocks of wood, which, when placed together and accurately fitted, shall alternately present a concave and convex form, and thereby tending to support each other." In short, but two kinds of blocks are needed, one narrow in the middle approaching the form of an hour glass; the other wider in the middle with its convexity fitting into the cavity of the other. "It will be seen that each separate block both supports and is supported by all those with which it is in contact, so that upon a weight being placed upon any particular block, the four surrounding blocks each assists in supporting the same, as, indeed, do all the other blocks for a considerable distance around, because it is impossible for any block to sink with carrying down four others with it; and these others are in their turn supported by such other blocks as they may be in contact with. It will therefore be evident that the strength necessary to support any weight, will be obtained from all the surrounding blocks." The editor of the London Journal remarks,—"This appears to us to be the best description of wood paving yet offered to the public and would be the most likely to meet with encouragement, if any economical method could be devised for cutting or forming the blocks with correctness.

The ingenuity of David Stead and Stephen Young (each having obtained a patent) appears to have exhausted itself in forming all possible combinations of shapes, in short in devising the most ingenious Chinese puzzles. The result is a claim on the part of both patentees to nearly every possible shape of block, from the most simple to the most complicated, and therefore the most useless. On feature common to both plans, or rather

to one of the many plans of each, is the use of a double course. The last notice we have to make is of the patent of Richard Hodgson. It consists in combining two wedges placed side by side with the point of each beside the middle of the base of the other, or else in the use of two oblique parallelopipedons fastened together in the form of X and the consequence of the use of either of these solids will be a perfect contact of all parts and a perfect keying together of the pieces not unlike the lattice bridge. There would be no objection to this plan were it not that the waste of material is great, except perhaps in the case of wedges where a careful management would avoid any great loss.

We have thus taken the trouble to throw into a condensed form the substance of the patents, with the desire that any hint of a useful character might be extracted, without the trouble of unraveling the complicated descriptions, as we have done at no small cost of time and trouble. But after all, these contrivances are rather curious than useful, and we much doubt whether either of these patentees will ever be reinbursed for the expense of the patent, &c. The superior strength of any one of them, will be more than counterbalanced by the increase of cost, and it must also be recollected that in the least complication of parts, the unavoidable shrinking that takes place will prevent the perfect contact necessary to insure a good and lasting pavement.

As far as strength and simplicity are concerned nothing can be better than prisms of four or six sides pinned together so as to distribute the strain where any one piece over a large space.

SELF ACTING SAFETY BRNAK.—We find in a recent number of the London Mechanic's Magazine, a notice and drawing of a self acting brake invented by Mr. Ware Jones. We merely allude to it as it shows no originality, and is similar to one described in Vol. 4 p. 231 of the Mechanic's Magazine, the invention of J. K. Smith.

For the American Railroad Journal and Mechanics' Magazine.

REMARKS ON THE "LAWS OF TRADE." By C. Ellet, Jr., *Civil Engineer.* No. 3.

In the preceeding numbers, the toll proper to be charged on the public works of the country, for the conveyance of objects of heavy burden, is determined in the supposition that there are limits and rules, prescribed either by law or by political considerations, which prevent a departure from some fixed amount per ton per mile; and, under this hypothesis, results have been obtained of remarkable simplicity, and very general application. But we are not to overlook the fact that it is only in cases where such imperative considerations govern, that a tariff based on the principles assumed could be adopted—since its adoption will be universally attended with a loss of revenue, and always productive of injustice to the public. Still, this mode of assessing the charges on the trade is in very general usage in the country; and it is therefore an important and interesting question to

determine *the amount* of the loss which it involves, by a comparison of the revenue obtained under an uniform charge with that which would be produced by a proper attention to the value of the commodity, the space it is carried, and the freight charged on the line.

It is elsewhere proved,* that when the work is yielding the highest results, the toll per ton per mile on any commodity transported a distance x will be

$$C=\frac{\Pi-x\delta}{2x};$$

and the tonnage due to this toll, which will be furnished by the two opposite branches joining the line at the distance x from the mart, will be represented by

$$T=t\frac{\Pi-x\delta}{\beta};$$

and the differential of the revenue which will be obtained from this tonnage under the charge C for toll, will be

$$t\frac{(\Pi-x\delta)^2}{2\beta}\delta x.$$

By investigating this equation we shall obtain for the value of the revenue between the limits $x=o$ and $x=h$,

$$R=t\frac{3\Pi^2h-3\Pi h^2\delta+h^3\delta^2}{6\beta} \qquad (E)$$

The extreme value of h is obviously $\frac{\Pi}{\delta}$; and consequently, by substituting this quantity in place of h in the equation, we shall have for the aggregate revenue from any commodity

$$R=t\frac{\Pi^3}{6\beta\delta}. \qquad (F)$$

The tonnage corresponding with the charges which produce this revenue will be represented by the differential equation,

$$dT=t\frac{\Pi-x\delta}{\beta}\cdot dx;$$

observing, as before, that the tonnage is obtained from the country on both sides of the improvement.

By investigating this equation between the limits $x=o$ and $x=h$, we find for the tonnage in that distance

$$T=t\frac{2\Pi h-\delta h^2}{2\beta}; \qquad (G)$$

which, when $h=\frac{\Pi}{\delta}$ (its greatest value) becomes

$$T=t\frac{\Pi^2}{2\beta\delta}. \qquad (H)$$

If we compare the expression of the revenue given in equation (F) with that which we obtained under the hypothesis of an uniform toll equal to

* "Essay on the Laws of Trade," page 65.

the charge for freight, we will perceive that they are of the same form—both being as the cube of the tare for carriage which the commodity will bear, and inversely as the cost of freight on the lateral branches and on the improvement—but that the revenue in the latter case is twice as great as in the former. Or, *where the charge for toll is adapted to the ability of the article, the revenue will be twice as great as the greatest revenue which can be obtained when the toll is some given amount per ton per mile.* At the same time, if we compare the tonnage under the two hypotheses, as given in equations (C) and (G,) we will perceive that it is the same in both cases—these expressions being identical. From which it appears that we would be able so to adjust the charges on that class of commodities now under consideration, that the revenue would be twice as great as in the hypothesis of an uniform charge, and that yet there would be no diminution of tonnage. But it would not be practicable to carry out this system of assessment quite to the extent here assumed, and it would probably be found advisable to make some modification of the charges on articles carried but a short distance, by which the revenue would be somewhat reduced, and the tonnage proportionally augmented. The effect of such modifications as are here adverted to, depend on various circumstances, which, though susceptible of being exhibited in a general solution, would be more conveniently exposed by particular application.

To obtain such a solution of the problem, we may regard the tariff as common to the two systems for a certain distance h, and then integrate both expressions of the revenue, between the limits $x=h$ and $x=\frac{\Pi}{\delta}$ in the one case, and $x=h$ and $x=\frac{\Pi}{2\delta}$ in the other, and compare the results in the particular applications which we desire to make.

Again, if we compare equations (F) and (H), we will find for the revenue under the tariff recommended in the "Laws of Trade,"

$$R=\frac{T\,\Pi}{3}; \qquad (I)$$

which teaches that when the tolls are judiciously levied *the revenue obtained from any article will be equal to the whole number of tons of that article which is shipped on the line, multiplied by one-third the charge for carriage which one ton will bear*—without respect to the distance through which any part of the trade is carried.

This method of determining the most advantageous tariff, may be employed in the question of railroad fares with very happy effect; but the consideration of that division of the subject will be deferred for a subsequent article.

To the Editors of the American Railroad Journal and Mechanics' Magazine.

Owing to field engagements during the past season, I was prevented from receiving your Journal regularly and paying attention to its perusal. But

I feel now called on to make some remarks on an anonymous article, which appeared in the second number of the month of July, on page 36, 37, 38, headed "*Theory of the Crank.*" The position I have assumed respecting the *Crank*, devolves on me the duty, either to acknowledge myself in error, if becoming convinced in the course of debates, of the incorrectness of the proposition, advanced by me; or to meet all objections, which appear to me unfounded.

The article referred to has the appearance of a plain and mathematical construction, equally well calculated to *convince* as to *deceive*. It would settle the matter at once and decide against my theory, if it was not for a slight mistake, which has crept into its construction. This mistake is nothing less than the liberty which the author has taken, *of proving the thing which is to be proved, by the thing itself.*

The reader is requested to peruse again the article in question, and to refer to its diagrams, fig. 1, and fig. 2, and to keep in mind that the action of the crank-pin is supposed to take place in the quadrant A B, fig. 1.

What I have asserted is, that there is a loss of power connected with the use of the crank, arising from the change of a straight motion into a rotary motion.

Our author now says, on page 37:

"Make the line *a b*, fig. 2, equal in length to the arc A B in fig. 1, and suppose ordinates to be erected from the several points between *a* and *b*, equal in length to those drawn from corresponding points in the quadrant. That is, *ah* and *ai* being equal respectively to A H and A I. From *a*, through the points *k*, *l*, etc., draw the curve line *a*, *k*, *l*, *d*, etc."

The crank-pin moves in reality not in a straight line, but in a circular line. Our author now has the arc A B metamorphosed into a straight line *a b*, and the ordinates, representing the leverage, *vertically to it*. Now since a straight motion has been substituted for a circular motion of the crank-pin, it follows as a matter of course, that *no* loss of power will be proved and that the principle of virtual velocity will be found to hold out. The vital part of the question has been at once circumscribed and silenced by the author, by presuming that a circular motion may be represented as taking place in a straight line; while I have been contending for, that a circular motion cannot be assumed as straight, even for the smallest particle of time or extent.

Again: I consider it a mathematical plunder, to resolve the leverage and to dispose of it, *without relation* to the prime mover or its course. But this has evidently been done in diagram 2, where the ordinates are represented verticals to the line *a b* which line is to represent the space through which the crank is moving.

The author says again on the same page, 37:

"As the crank in passing with an uniform motion from A to B or its equal *a b*, acts with the different levers represented by the ordinates, drawn to the several points, it follows that the area of the figure *a l d b* represents

correctly the sum of all the different levers, upon each of which the power operates an equal length of time, etc."

I now ask, who can assent to confound the way of the *prime mover* with the way of the *crank-pin?* Is not the leverage always to be calculated vertically to the direction of the prime mover?

The sum of momenta produced during a quarter revolution upon the centre D, fig. 1, is equal to the product of A D × *by the total leverage of the quadrant.* The leverage of the quadrant is represented by the sum of ordinates H K, I L, B D which are drawn vertically to the direction of the prime mover WITHIN THE QUADRANT. We cannot construct the leverarge as taking place under other forms and circumstances, nor *outside of the quadrant* nor in a larger space than the quadrant.

From all those reasons I must object to the Theory as offered by the author.

The communication of Mr. B. Aycrigg, in your Journal of September 1st, contains a critic of my last reply to his first writing on the crank.

In answer I beg leave to state, that his argument, as far as my position is concerned, appears to me unsatisfactory.

I do not understand at all Mr. Aycrigg's objection to what I consider to be a self evident truth, viz.

"*That the respective velocities of the prime mover and of the crank-pin are as the spaces through which they have actually moved.*"

By what are velocities of motions expressed or represented or measured? No doubt by the extent of spaces, through which the motion has taken place for a certain space of time. It matters nothing, if the time of motion was a fraction or a whole; it matters nothing if the velocity of the crank-pin is considered for an instant or for the whole time required for a whole revolution. What is true for a single instant, is also right for a multiplicity of instants, provided the multiplicator is the same on each side of the equation.

I say, it is impossible to deny that the velocity of the crank-pin is in exact proportion to the space through which the pin has moved, either for an instant or any other extent of time. The space now, through which the crank-pin is moving, is represented by the arc, and the motion of the prime mover is measured by the verse sine. Therefore the following rejected proportion: V : *v* : : sine verse *c* : arc *c* appears at least to my mind, perfectly correct.

I have said that the verse sine can bear no definite relation to an arc, and Mr. Aycrigg asks: "*Does he then mean that the respective velocities of the prime mover and of the crank-pin have no definite relation to each other?*" I mean exactly what I plainly expressed: *that the verse sine can bear no definite relation to an arc,* and nothing else. The verse sine can bear no more definite relation to an arc, than the radius does to the circumference of a circle. Both relations are indefinite and cannot definitely be expressed. It follows of itself, that the relation of the veloci-

ty of the prime mover to that of the crank pin cannot be a definite one, they being to each other as the radius to the quadrant. And the relation of the two last quantities is expressed by a decimal fraction without limits.

The simple *Theory of the Crank*, which was first offered by me, was itself never scrutinized, except in one case, which was explained by me.

Now it is plain, that one demonstration is all sufficient, and that, if a proportion has been proved *right* once, it cannot be proved *wrong* another time. But this has been attempted with respect to my theory. Instead of explaining, in what the fallacy of the reasoning of the new proposition consisted, other demonstrations have been offered for the purpose of proving *no loss of power*.

I should feel obliged to any gentlemen who will trouble himself to examine my demonstration carefully, and will point out in inoffensive language, where I have erred. So far I have no reason to abandon my assumed position. No fallacy has been discovered in it and the opposition demonstrations are as yet unsatisfactory, at least to my mind.

JOHN A. ROEBLING, C. E.

AN ESSAY ON THE BOILERS OF STEAM ENGINES. By A. Armstrong, Civil Engineer.

(Continued from p. 285.)

ON THE FORCE OF EXPLOSIONS.

From the premises we have laid down, it may fairly be concluded, that the pressure of steam, suddenly generated at the moment of explosion, will bear some near proportion to the area of the hole or aperture, and as the actual pressure exerted the instant after the aperture is formed, must be equal to the previous pressure drawn into, or multiplied by, that area, we may assume the square of the area, or fourth power of the diameter of the aperture, as representing a good approximation to the proportional force exerted—the reaction of this force propelling the boiler in a direction opposite the aperture.

Hence we have a reason why the bursting of a comparatively small hole in a boiler bottom produces such a very feeble effect, as compared to one of six or eight times its diameter. For if the force of explosion in any given case be called 1, then the force in any other case, producing an aperture of double the diameter of the former (other circumstances being the same) will be represented by $2^4=16$; if of

3 times the diameter, it will be	$3^4=81$
4 times	$4^4=256$
6 times	$6^4=1296$
8 times	$8^4=4096$

Some persons who have paid a good deal of attention to the circumstances connected with explosions, have doubted the possibility of steam being generated in sufficient quantity so suddenly as my explanation would seem to require; this, of course, is a matter which can only be proved by direct experiment; and such an experiment is yet a desideratum in this country. At present we have only one of the American experiments which throws any light upon this part of the subject; the repeating of this experiment on a large scale is highly desirable, although it would be attended with some danger and not a little expense. In the one alluded to, water was purposely injected into the boiler when the bottom was *red hot*, by

which means the steam was raised from one up to *twelve* atmospheres (180 lbs. per square inch) *in one minute*, when the boiler exploded with violence. The American report states that in the violence of the effect, the experiment was not carried so far as it might have been, from not throwing in a sufficient quantity of water; consequently, the metal was not *cooled down to the "point of maximum vaporisation"* when the explosion took place, otherwise the pressure, as indicated by the thermometer the moment before the explosion, might have reached about 40 atmospheres in the same time.

The above mentioned experiment supplies an illustration of the general inutility of safety valves in case of sudden explosion. The safety valve is, in fact, a perfectly useless appendage to a low pressure boiler provided with the ordinary feed pipe in common use in factories; more especially when the buoy rod is made to pass through an open pipe of the same height as the feed cistern, instead of working through a stuffing box. This well known feeding apparatus is an infallible preventive against the steam getting (*gradually*) too high, as well as against the water getting too low; the latter being by far the most dangerous predicament of the two, and a frequent cause of explosion.

When a boiler bottom becomes very highly heated through the water getting too low, and a quantity of water is suddenly let in, the consequences are similar to those we have already described; for the internal coating of scale being suddenly contracted by the admission of the cold water, it is detached in the same manner as by the expansion of the iron, and the same effects are produced, although perhaps more speedily, as the water admitted will reduce the temperature of the exposed part of the boiler bottom more rapidly to the maximum evaporating point.

It may be asked, if our theory of steam boiler explosions be correct, how it is that we have not many more of them, as the causes to which they are ascribed may seem to be of almost every-day occurrence? The answer is, that the *bursting of boilers* is also a matter of every-day occurrence, to an amount which the public generally are altogether ignorant of. To be sure these burstings are not generally called *explosions*, although in reality they are so, being different only in degree. It would not be difficult to prove that two or three of these minor explosions occur in Manchester every week; but when no fatal consequences ensue, and no particular damage is done to any adjoining property, of course the circumstance never gets into the newspapers, and no public notice is taken of it.

Usually, the affair has quite another name when it occurs with a wagon boiler; it is then said that the "boiler bottom has come down;" in other words, the concave bottom is forced down into a convex form, and sometimes the sides are in like manner forced outwards, about the middle of the length of the boiler. The consequence in the least violent of these cases is, that the boiler is lifted up a few inches from its seating by the bottom striking upon the top of the fire bridge. We also usually find every seam of rivets violently strained, so that the water runs through the boiler bottom like a riddle, although there is seldom a hole of more than a few inches in area.

The above remarks of course have reference principally to those cases where the metal of the boiler becomes unduly heated, either in consequence of the water getting too low, or from the interposition of incrusted deposits, as described in the preceding articles (239, etc.) There are, however, other concurring causes that frequently modify the result; such, for instance, as when, instead of the bottom or sides of the boiler, it is the top of the inside flue that becomes unduly heated. And this is an extremely

likely cause of explosion, when the furnace is contained within the flue, as in the Cornish boiler and some others.

There is a very erroneous, although prevailing opinion, that the Cornish or Trevithick boiler, with the fire inside the tube, is safer than any other kind, which opinion cannot be too soon dispelled. For it is an admitted fact by all who have considered the subject, and however they may differ as to the precise theory of its action, that the water getting too low is a frequent cause of explosion; and if so, it must be evident that this cause must operate much more frequently to produce such an effect, when, as in the Cornish boiler, the depth of the water over the hottest part of the heating surface is only a few inches, than when the depth is as many feet as in the wagon boiler.

The force of the steam and water escaping during an explosion of a Cornish boiler is, however, immensely increased, by reason of its being generally all expended in one direction, that is, through the fire place in the mouth of the tube. The latter being thus converted into a sort of cannon or mortar, from which the grate bars, fire bricks, and other materials are projected with destructive effect, on every thing within their range.

It is also not improbable that the steam, as it rushes out, is reinforced by contact with the heated fuel in the furnace.

There are, besides the above, some other circumstances that have been observed in the bursting of a boiler of this kind, which show that the explosion bears considerable analogy to the discharge of an immense piece of ordnance. Such, for instance, is the sound or report produced by the explosion, and which is not experienced in so remarkable a manner with boilers that have not an internal flue.*

It frequently happens that explosions of the Cornish boiler occur without the latter being in the least disturbed or removed from its place; such were the two fatal explosions on board the *Victoria* Hull steam ship on the Thames, in March and September, 1838, the particulars of which are well known.

An explosion of a similar kind to those in the Victoria steamer, also took place not many months ago with a Cornish boiler at the Viaduct foundry, at Newton, in Lancashire; but the boiler being a high-pressure one, the force of the explosion was much greater than in the former case. Several tons in weight of cast iron and other articles were removed by it, and a breach was made by them, of ten yards wide, through a strong wooden inclosure that surrounded the foundry yard. Indeed, every thing in the direction of the mouth of the tube, for 60 or 70 yards in a direct line and two or three yards wide, was swept away with terrific violence, including ten or eleven workmen, nine of whom were killed. The bricks which had composed the fire bridge within the tube were projected like shot from a gun to twice the above mentioned distance, and were the principal cause of the loss of life. The report was described as like a loud clap of thunder.

It is necessary to say that the incrustations of which we have spoken as common cause of explosions, had nothing whatever to do either with this case, or those of the Victoria steamer, the boilers being quite new; these instances are only adduced as illustrations of the peculiar destructive violence incidental to this particular kind of boiler, owing to the steam be-

* It has been observed, that when one or more flued boilers are working in connection with another which explodes, the water immediately boils out of the former into the latter, and a continuation of the effect is produced for several seconds, together with a prolonged rumbling sound, which has been described as like thunder.

ing reinforced as it were within the tube, and then being all expended in one direction. Respecting the causes concerned in those particular explosions we shall have more to say.

ON EXPLOSIONS CAUSED BY MALFORMATION OR WEAKNESS OF SHAPE.

We may take the last stated case of the Viaduct foundry boiler as an illustration of this class of causes, for although not very commonly productive of explosions properly so called, they deserve the particular consideration of the users and makers of *high-pressure* boilers.

The peculiar fault of this boiler and the proximate cause of its bursting was, that the tube or internal flue was oval in section, although the boiler itself was circular.

Now the main object in making an inside flue oval and placing it with the shortest diameter vertical, is no doubt the obtaining a greater depth of water over the flue without diminishing the heating surface; but by thus endeavoring to avoid the chance of an accident arising from a deficiency of water, we run into the contrary extreme, and risk an explosion by making the flue of a weak form.

A very slight departure from the true circular figure, not only causes a flue to be much weaker, but the pressure has a constant tendency to still farther alter the form of the curve, thereby becoming weaker with every strain, until the boiler bursts by what is called a collapse of the flue; that is, the two sides are usually crushed flat together, or nearly so, and the rupture consequently takes place in the flue itself, through which the steam and hot water are discharged in the manner we have already stated.

The Viaduct foundry boiler was 12 feet 6 inches long, by 4 feet 9 inches in diameter. The inside flue was 3 feet wide, by 2 feet 6 inches deep. The fire bridge was at about one-third the length of the flue, and the top and bottom of the latter were crushed together at about midway between the back end of the boiler and the bridge; the latter no doubt by acting as a momentary support to the top of the flue at the instant of the plates coming down, determined the place of the collapse.

The above boiler was quite new, the explosion having taken place the first morning it was set to work, and within one minute after starting the engine. The plates were of three-eighths of an inch thick, and, saving the *form* of the flue, the boiler was remarkably well made, as well as all the apparatus belonging to it. It had two *safety valves*, two gauge cocks, and a glass water gauge. The foreman of the works, who had the superintendence of erecting both the boiler and the engine, (the latter being also new and of eight horse power,) was present and managing them himself when the explosion took place, he being also one of the unfortunate sufferers.

The verdict of the coroner's jury in the above case was "accidental death *occasioned by the insufficiency of water in the boiler*," which conclusion seemed to be arrived at, either from insufficient evidence, or inability to account for the accident in any other way; although there was direct evidence to the contrary, namely, that the gauge cocks indicated sufficient water a few minutes before the explosion, and that no steam was blown away in the interim. In concurrence with the opinions of the jury were those of several most respectable engineers, but with the addition, by some of them, of ascribing the explosion to the *sudden formation of hydrogen gas*, by the injection of cold water upon the supposed red hot flue when the engine started. This last opinion is far from being a singular one in many similar cases of explosion that have occurred with high pressure boilers, but is, as we think, a very erroneous one, not to say fatally so, in

many instances. For by thus assuming a theory which, to say the most for it, is, according to our ordinary knowledge of the laws of chemistry, extremely improbable, a check is, to a certain degree, placed upon any further investigation, while the real errors of construction are perhaps kept out of view or repeated in other cases.

Now, if instead of the flue the *boiler* itself had been *oval* and the *flue circular*, the same means of obtaining a greater depth of water over the flue would have been afforded, but with much greater safety from explosion or collapse. For although an elipse or oval is a weaker shape for a boiler than a circle, still from the pressure being *inside the curve*, any extra strain or pressure that the boiler may be exposed to, will only have a tendency to alter the curve into a stronger shape than it was before, or to approach more nearly to the circle. On the other hand, when the pressure is on the *outside of the curve*, the effect is exactly the reverse of the above, the strain having a constant tendency to put the curved surface into a weaker position; consequently it follows, that a boiler slightly elliptical or oval in section, is, for all practical purposes, as strong as if it were circular; while, in an internal flue or tube, where the pressure acts externally to the arch or curved surface, if the curve is not truly circular, the tendency to give way and be crushed inward by what is called a collapse, will increase in an increasing ratio with the strain.

Hence it ought to be a rule in the making of high pressure boilers, that the inside flues, besides being circular, should also have their plates quite as thick, if not thicker, than the external shell or case. The boilers themselves may be to a considerable extent elliptical, even so much as in the proportion of 6 to 8, without materially diminishing their ultimate strength. Contrary, however, to the above recommendation, we frequently see a different practice followed, that is, the dangerous one of making oval inside flues of thinner iron than the boiler. If the peculiar form of boiler should in any case absolutely require oval flues, which may possibly be allowable for low pressure, those parts ought to be carefully supported by stays.

ON EXPLOSIONS CAUSED BY IMPROPER POSITION OF THE HEATED SURFACE.

An attentive perusal of the section on the position of the heating surface (in Chap. III. Art. 120, etc.) together with the preceding sections of the present chapter, besides bearing in mind what has been hitherto generally known on this subject, will, it is to be hoped, enable us to eliminate all the causes that were ever concerned in producing explosions of steam engine boilers; and perhaps also put us in a condition to assist, if not in preventing, at least in placing some check to, the increase of those lamentable occurrences, and thereby tend to the removal of the only remaining barrier of any consequence to the further progress, and eventual complete triumpth of the empire of steam.

There are only two ways in which a boiler can be made to burst or explode by the power of steam. One is by a gradual increase of the pressure produced in the usual way, but at a time when all egress is prevented until the steam acquires sufficient strength to force its way out by a rupture of the material of which the boiler is made. The other way is by some *sudden* increase in the quantity or pressure of the steam, to such an extent, that the ordinary safety valves, or perhaps any other means of outlet that might be devised for the purpose, are unable to carry it off with the requisite rapidity for preventing any (although but momentary) strain greater than the boiler can bear. We have long been of opinion that it is in the

consideration of the last above two classes of causes principally, that we ought to look for the proper remedy.

It will be recollected by those who read the newspaper accounts of the second explosion on board the Victoria steamer last summer, that great stress was laid upon the peculiar nature and situation of the injured portion of the boiler, the principal place of fracture being the lower part of the inside flue or tube by what is called a collapse of the flue *upward*. The boiler was on the circular or Cornish principle, that is with the fire place inside the tube, which was slightly elliptical, but of a very large size, so as to allow of merely a shell of water between it and the external case. Moreover, this boiler contained an inner tube within the flue tube, containing water, and communicating by means of short pipes with the upper part of the boiler, similar to some that have been lately introduced in Cornwall, therefore it has been called the "improved Cornish boiler." The boiler in this case had return flues underneath its bottom, and set up somewhat similar to the ordinary manner in which a Butterly or Cornish boiler is set up for mining or factory purposes,—a highly objectionable method, in our opinion, when applied to a steam vessel; and we have no doubt of being able to show that this assisted in the production of the fatal catastrophe which took place in the Victoria.

A collapse of the flue upwards is not an uncommon occurrence in factory boilers that contain inside flues with rather flat bottoms; and it frequently occurs with what are called Butterly shaped boilers, or those which have the mouth of the inside flue a very flat oval, particularly behind the bridge where the fire first passes into the tube.

On this particular portion of the bottom of the flue of a Butterly boiler, and for a considerable distance beyond the bridge, we have known small coal and coal dust to accumulate into a heap of some magnitude. Now with a pretty strong draught, and the flame reverberating downwards, as it necessarily does in both the Cornish and Butterly boilers, this heap of coal dust occasionally takes fire and burns with more or less intensity according to circumstances,—never perhaps with sufficient intensity to make the iron any thing like approaching to a red heat in the first instance, but rather gradually to deteriorate and weaken the iron in the manner we have before pointed out, in the case of the side plates of the furnaces of marine boilers; excepting that in this case the injury is more rapidly effected from the circumstance of the bubbles of steam which rise from the lower heating surface coming continually in contact with the bottom and sides of the inside flue; thus, in some measure, preventing the water from carrying off the undue heat accumulated in the iron plate above it.

We have occasionally met with instances where the mischief done in the above way was first evinced by the bottom plates of the flue being so far weakened or softened as to give way to the pressure of the steam sufficiently to form a dish-like protuberance within the flue, and consequently a corresponding concavity on the under side or that next the water, into which the steam would of course accumulate or become locked in the manner described in Article 152, etc. Now, after the injury has proceeded thus far, it is very evident that a second accumulation and ignition of coal-dust, may cause the injured part to become rapidly red hot, or sufficiently so as to cause the flue to burst upwards with the ordinary pressure of the steam, and this effect is in fact what frequently takes place. We have had many opportunities of tracing the symptoms indicating the above effects, from their source, as above stated, to their full development in an explosion; and in one particular boiler in Manchester, this occurrence took place twice exactly in the manner above described.

That similar causes would produce similar effects in the Victoria boilers we have no occasion to contend, the priniples of their construction being the same as we have brieffy described above, the details of which any one may see by referring to the engravings of those boilers, published in the Civil Engineer's Journal, and also in the Mechanic's Magazine for last year.

The evil in all such cases arises from the principle (whether incidental or designed) of *heating water downwards*, which is essentially bad, and respecting which we have largely expatiated in various parts of this work. But our present business being principally with land or factory boilers, we have only to state that the evil is usually prevented by keeping the flues well cleaned out; but it would be better still, perhaps, to cover the bottom of the flues with fire bricks, or a coating of Roman cement, or any substance that is a bad conductor of heat.

In the particular case mentioned in the last article the flue was about five feet by three, and assumed a kidney shape—the transverse section having the indentation at bottom. The plates were about 3-8ths thick, and the pressure 9 or 10 lbs. per square inch.

(To be continued.)

FOURTH ANNUAL REPORT OF THE L. C. AND C. RAILROAD COMPANY.

(Continued from page 310.

From the report it appears that a portion of the advances made by this company have been refunded from the income of the Hamburg road; but as these fall short of the interest on the entire debt contracted, the result is not varied, and the cost of that road to the Louisville, Cincinnati and Charleston railroad company, remains fixed at upwards of three millions of dollars.

The locomotive power is reported as efficient and equal to all the probable transportation for the coming year on the road; and the work shops are represented as under efficient management, and in a condition not only to keep the requisite number of engines in order, and in active service, but to reconstruct those which have been disabled, and to furnish the additional number of new ones which may be demanded by the increased transportation on the road. There was a deficiency, however, of freight cars; and the additional number required are under construction. The work shops, sheds, and other structures at the depots, and particularly at Hamburg, and at that near Charleston, are all temporarily arranged without much order or with a view to permanency, and being of wood are much exposed to fire. An accident of this kind might not only result in great pecuniary loss, but in the entire suspension of the business of the road, as inconvenient and as embarrassing to the community as it would prove to the company. All these must require, in the progress of time, at a more convenient period than the present, entire new construction, and of materials which will render them more durable, and exempt from being fired. The depot on the Neck near Charleston, it is alike the interest of the company and of the community to advance into, or on the borders of that city; for it seems absurd, that a road intended to make more perfect the commercial connection between the interior and the shipping point short of its accomplishment. At the other extremity at Hamburg, there are considerations equally as imposing, and to which the community of Georgia, and all interested in the railroads intersecting that State, however opposed at present, must soon yield, for the advancing the South Carolina road into Augusta. At present the merchandize and produce of the country are subject at the two extremities of this road to a bridge, wagon and dray tax—in some cases equal to

40, and in most from 20 to 25 per cent on the entire freight from Charleston to Hamburg. All these impediments to a free and cheap intercourse between the harbor of Charleston and the interior, will involve further improvements; and therefore it has been recommended that from the capital to be paid in under the charter to the Louisville, Cincinnati and Charleston railroad company, there be reserved at least three millions as necessary to meet the obligations for the purchase, and the more permanent construction of the road from Charleston to Hamburg and Augusta, so that it may fulfil all the great objects for which it was originally projected. At that sum it will be found a purchase, and investment remunerating in time, it is believed to all, who retain their interest as share owners. To the Louisville, Cincinnati and Charleston railroad company, embarking as they have in an enterprise of great magnitude, of incalculable importance to the south and west, and involving a large amount of expenditure it was invaluable; and in the consummation of this purchase, we may now, with the greater confidence look to the ultimate consummation of the great objects for which that company was chartered. They received a road admirably located, the longest which has been constructed in the United States, organized in its government, and in full and successful operation in all the departments of police and transportation, for its management, with work-shops and motive power, and a most efficient class of mechanics, mechenist, and enginemen, most, if not all of whom had been educated in its own native school at the Depository, and where they imbibed, and still retain, an attachment or esprit, for the road. The expense, and the time, which would have been necessary to have organized, and to have given impulse to these arrangements, on a new and independent road, would have been incalculable. Already on the short section of road to Columbia, which has been completed, have the benefits of the connection with, and ownership of the Hamburg road and work-shops, been most advantageously experienced. Without the necessity of an additional outlay for new engines, passenger, and freight cars, &c., and with all the hazard of subjecting our first transportation operations to the management of discarded conductors, enginemen of other roads, or to those who only had the passport of a recommendation, and free from the embarrassment of having to negotiate with an independent road, by which the freight and passengers from Orangeburg, and beyond, should be expedited to Charleston on their track; it was only necessary to give orders to bring in harmony the transportation and travel in both directions, meeting at Branchville, and to furnish an engine and competent attendents, and the work was accomplished, and at a moderate expense, compared to what would otherwise have been incurred.

FINANCES, INDEBTNESS, ETC. ETC.

The Report of the Secretary and Treasurer, exhibits a statement of the finances and indebtedness of the Company up to the first of September, 1840. The expenditures have been separated and made chargeable under the different heads to which appropriated. The indebtedness of the Company, though greatly reduced, and brought more within our ability to meet it, is still large, and the expenses enhanced from a heavy, and unavoidable interest account, which has, and must continue to consume a large portion of the resources of the company, if these debts cannot be provided for, or extinguished by the payment of instalments on the part of the stockholders. The amount of arrearages lying over, and probably equal to if not exceeding our bank engagements, and the mistaken policy hitherto of postponing the regular calls every sixty days, as the charter prescribes, for the sums necessary to build the road, and of granting indulgence, at the same

time that we were pressing forward with the work, had superinduced a system of loans to meet pressing claims, which has not only operated to the prejudice of the treasury, but very sensibly increased the cost of the enterprise. To this fact must be ascribed much of the excess of indebtedness which will remain over and above the capital estimated as ample, in the previous part of this report, for the construction of the two roads owned by the company, and which would have been adequate, but for the diversion, under a mistaken policy of credit, a proportion of the sum from its original legitimate objects; from the payment of debts, to the payment only of interest on debts, still remaining unliquidated. This interest, therefore, has oparated as a sponge, which has silently, but surely absorbed the slow receipts of our capital, and must remain as a large item, unexpectedly, but now unavoidably charged to either profit or loss, and to be added as an item on the amount of capital invested on the road.

In the division of surveys, the Engineer has, under instructions, divided the amount charged against the road, as far as Columbia, the sum fairly appropriated on that section, dividing among the other States the sums expended within their respective limits for said service, and leaving an amount chargeable against the company for the surveying operations above Columbia. Though these divisions were made with the view to the separating of the funds of the different States interested in the enterprise, as required by a resolution of the stockholders, and to ascertain as far as practicable, the amount for surveying chargeable on each section of the road, it cannot altar or diminish the liabilities of the company in the aggregate. The amount, therefore, for surveys beyond Columbia, though as a separate item, chargeable hereafter to the road above that place, is still so much of the company's funds prematurely disposed of, and which must remain as slumbering capital, unavailable until the enterprise advances beyond that place.

There has been expended for surveys, instruments, etc. in the Engineer department, up to the 1st September, 1840, $221,102 18

Of this amount there is chargeable against the section of road between Branchville and Columbia,	$85,000	
Above Columbia, in South Carolina,	43,102 18	
In North Carolina,	24,500	
In Tennessee,	23,500	
In Kentucky,	45,000	
		$221,102 18

From the Treasurer's Reports the liabilities of the company, up to the same period, are

To the Banks of Charleston,	$201,892 00
To Bankers in London, for advances,	14,300 60
To City of Charleston for advances on stock,	39,139 53
To State of South Carolina for advances on stock,	474,077 37
To State of South Carolina for advance to Hamburg road,	138,223 59
To notes drawing interest, and payable at 12 months date,	247,897 25
To Scrip (*Receivables*) of the denominations of $5, and under,	44,425 00
	$1,159,955 34
Add amount necessary to complete the road to Columbia,	805,036 54
	$1,964,991 88

Deduct bonds and notes in hands of Treasurer, which may be available,	127,872	
Amount of the sterling bonds, still in deposit with our bankers in London, at their par value,	51,111	
		178,983 00
Leaving to be provided for, ultimately,		$1,786,008 88

Though the subscription lists exhibits some 80,000 share owners, there are represented in the South Western Railroad Bank, but 51,198 shares held in the State of South Carolina; 14,409 held by the State, city of Charleston, and other incorporations; and 37,689 by private individuals; on 37,000 of which two instalments in bank, amounting to 25 dollars have been paid. It is assumed, therefore, that all who have advanced that much in cash, over and above payment on the road, will not hazard the forfeiture of the stock made so valuable by the amounts already paid in. We may safely presume therefore, on 50,000 shares, as the number on which will be paid all the instalments as they accrue. As yet there has been a call of but $30 on each share for the road, and a large portion of this has not been paid; leaving arrearages on the 3d, 4th 5th, and 6th instalments which cannot fall short of 150,000 00

Six more instalments, of $5 each—$30, or $60 in all, on each share, ought, on 50,000 shares, to yield $1,500,000 less 90,000 already paid in advance by State and corporations, 1,410,000 00

$1,560,000 00

Deficiency, which can be met from the receipts of the road, 226,008 88

$1,786 008 88

As a proportion, however, of the above liabilities are not pressing, and the debt to the State may be deferred by paying interest; and as the amount of work yet to be done, will be paid in obligations at 12 months date; and arrangements for the iron, from Europe, can likewise be effected on time; we repeat, that if the arrearages due on instalments are paid, and the four calls, now made by advertisement, on the stockholders, are promptly met, that the two additional sums of $5 each, to make up $60 on each share, already paid in, the larger amount has been absorbed, in meeting the purchase of the Hamburg road; and no small sum expended on surveys in anticipation of the road progressing hereafter beyond Columbia. But a very small proportion, therefore, of the payments made, have been available in the construction of the road between Branchville and Columbia. Most of the work, hitherto, on that section, has been accomplished on credit and loans, which will explain the past indebtedness of the Company to the banks; and latterly, through the agency of our obligations, in the form of promisory notes, which have thus far performed their functions most satisfactorily; and, without the aid of which, we should have been forced for the season to suspend operations. The increasing confidence which has been reposed in this paper, must stimulate our stockholders to meet their engagements for instalments as called in; and our obligations honored, as they will be at maturity, will leave the Company in possession of two hundred and two miles of Railroad, which will have cost, and is intrinsically worth five millions of dollars; on which there will be due only a deferred debt of two millions; subject to an interest, annually, of but 5 per cent. The receipts on the entire line of road not falling short of seven hundred thousand dollars, at the close of the first year after completion; and most probably increasing, in time, to eight or nine hundred thousand

dollars, must under an economical system of government and expenditure, yield not less than 7 per cent., dividend on the capital involved in the enterprise, appropriating to the three millions paid in by the stockholders their share; there will be left a two per cent. sinking fund on the deferred 5 per cent. debt of two millions, pledged for its final redemption. Should the opetions of the road fail in the accomplishment of this end, on which there seems not the least shadow of just apprehension, as a further security to the State of South Carolina for the guaranty of said debt, the additional sum of $40 on each share, not called in, but provided for in the charter, may be pledged to meet, faithfully this obligation. Our great difficulty is, the progressing of the unfinished road to Columbia, at a crisis of such unexampled pressure on the monied interests of our country: for the question is not to be mooted, that whenever the road is completed to Columbia, as it has been to Hamburg, that they will unitedly accomplish all our just expectations.

THE ROADS, THEIR LOCATION AND PROSPECTS.

The Louisville, Cincinnati and Charleston Railrod Company, in virtue of their own charter, and of the interests purchased of the South Carolina Canal and Railroad Company, are now in possession of all the Railroad enterprises within the limits of South Carolina, enjoying the peculiar advantages of being able to give *unity* and *harmony* of movement to the travel and transportation of the community. In one direction they have a road from the city of Charleston of one hundred and thirty-six miles in extent, completed and in successful operation, and having reached the terminus of the State in that quarter, it only awaits the progress of events *certain though slow*, of consummating a more perfect union with those numerous works, now under construction, and which have been projected with the view of intersecting the productive States of the south and west.

In another direction and diverging from the above road at Branchville, our Company have under construction a road, a portion of which has been finished, to Columbia, penetrating the interior and one of the richest portions of the State of South Carolina, and demonstrating, in its future projected extensions beyond that place, on the vallies of the upper Tennessee and of the Ohio rivers, as well as on the rich and flourishing mineral and manufacturing districts of North Carolina.

It is not to be credited, that in the successful accomplishment of this first section of a grander design, the greater enterprise, (in the progress of events, and in times more propitious than the present,) will be permitted to fail, through the indifference or want of support on the part of the citizens of other States, equally as interested as those, who have put forth their strength at the commencement.

It is due, however, to the States of North Carolina, Tennessee and Kentucky to call the attention of their citizens to the resolution passed at the last annual meeting of this Company at Ashville, in which it was declared, "that this company now reiterate their declaration, that without the united assistance of the States through whose territories the road is to pass, the work cannot be accomplished, and they now make their solemn appeal to those States, and are compelled to declare, that unless they speedily and cordially co-operate, this Company will be unable to progress with the enterprise."

The location of these roads, that to Augusta and Hamburg in one direction, and to Columbia in the other, and commencing at the most populous commercial city, and at the most accessible harbor south of the Chesapeake, is peculiarly advantageous. They form, as it were, the centre links in a

chain of Railroad and steamboat transportation, on which have commenced and, as certain as the tides at their appropriate seasons, will continue to ebb and flow, the moving and enterprising population and interior trade of these States, from the most eastern to the most southern and western extremity of the country.

The chain of roads and steam navigation from Salem and Boston via. New York, Philadelphia, Baltimore and Washington, the Fredericksburg, Richmond and Petersburg, and the Portsmouth, Roanoke and Wilmington roads has already been completed. Branching from the Roanoke by a more interior direction, and another chain has been commenced via. Gasson and Raleigh in North Carolina, which in the progress of enterprise and improvement, must in time, force its way by the Bend of the Yadkin, or by Fayetteville, Cheraw, and Camden, to its junction with our road, either at Columbia, or at or near the viaduct over the Congaree, pursuing in its course the line designated and projected in the map of the United States as the *Metropolitan Route.* In the south and west, the map exhibits traces of roads in Georgia, Tennessee, Alabama and Mississippi, no less important, and equally dependent upon one great design, of *general intercommunication among the States.* First, from Savannah in a direction to Macon and Augusta, ninety miles of which has been completed. Second, from Augusta to Decatur on the Chattehoochee ridge, one hundred and sixty-five miles, one hundred and eight of which is in a finished state. Third, from Macon, via. Forsyth, to the same point, all of which is under graduation;—and fourth, the Georgia State, or Atlantic and Western Railroad, from Decatur the termini of the above roads, to Ross' landing, or Chattanooga, on the Tennessee river, a distance of one hundred and thirty miles, the whole of which has been located, and the graduation of most of which is in a very advanced state. With the same views, and aiming at the same central point of connection, we see in Alabama a road commencing at Montgomery, 25 miles of which is completed, in progress towards West Point, on the Chattahoochee, with a further object of uniting at Covington, or at Decatur, with the Georgia, and the Western and Atlantic Railroads. In Tennessee a successful effort by the Hiwassee Company, from Knoxville, tending towards the same point. At Memphis, on the Mississippi, a road to La Grange, 57 miles, has been commenced, most of it has been graded, and the whole in progress of completion; looking in the liberal grants which have been accorded by the States interested, to an ultimate union with the road, now completed, and under operation, from Tuscumbia in North Alabama, to Decatur, on the Tennessee river. In a more southerly direction, a new line has been projected, and the initiatory steps taken for its execution to unite the Montgomery and West Point road in Alabama, via Selma, with Jackson, Vicksburg and Natchez, in the State of Mississippi. Other projects by which Railroad communications between the roads enumerated, and Apalachicola, St. Joseph's, Pensacola, Mobile and New Orleans, are under examination, and will no doubt receive in time, the favorable action of those interested. All these roads, crossing as they do, the great rivers flowing through the south and west, at points accessible to an ascending and descending navigation, make those streams tributary to the more extended commercial intercommunication the roads are designed to promote.

The line, however, of South Western Railroad, and steamboat transportation, which has been long projected, now attracting much interest, and which is nearest to completion, is that by Augusta and the Tennessee river to Memphis, on the Mississippi. Of the above distance, 579 miles, from Augusta to the Mississippi, there is 145 of Railroad transportation, and

130 of steam navigation, now in use; 187 of Railroad, under construction, and rapidly advancing to completion, and only 117 miles of Railroad though projected, located, and in part provided for, which has not been commenced. The peculiar feature, however, of this route, and which most strongly recommends it, is, that by a peculiar deflection to the south of the Tennessee river, known as the Big Bend; the navigable waters of the Mississippi, *are actually brought within* 295 *miles of Augusta,* on which line there remains but 57 miles of Railroad, which has not been commenced, but which has been located, and it is believed will soon be under contract. The avenue to that river, thus opened by the energies and enterprise of the State, and citizens of Georgia, at once consummates in one direction, the so much desired connection between the east and the west. The Tennessee river is reported by the United Engineers, who have carefully examined it, as a navigable stream bearing a favorable comparison with that of the Ohio; and as the navigation is equally as good to Ross', as to Gunter's landing, the terminus of the Alantic and Western Railroad, at the former, saves the difference of distance between these points. In an able and interesting report of the Canal Commissioner to the Alabama Legislature, charged with the improvements on the Tennessee river, now in progress, we make the following extract:—"The river in average years discharges about the same quantity of water as the Ohio, with the exception of the obstructions at, or near the Muscle Shoals, which may be canaled through the whole extent for less than has been expended on the falls of the Ohio, at Louisville; it is equally adapted to navigation in an extent of 600 to 800 miles, with the additional advantage of exemption from ice, which causes frequent interruption to the navigation of the Ohio, at irregular intervals from November to March." The obstructions therefore, at the Muscle and Colverts Shoals, and some other points which have been examined and for which there have been liberal appropriations on the part of the General Government, removed; and an uninterrupted navigation for steamboats may be obtained from the terminus of the Georgia road at Chattanooga, and by a descending current, to the valley of the Ohio. That all these projects, originating in different States, and by independent companies, as parts of one general design, will in the course of time be finished, we have the guarantee of the enterprise of the age, and of the wealth and productiveness of the countries they are intended to intersect, and accommodate. Most of the Railroad projects in particular will be accomplished. They have advanced too far to halt, and every day's experience seems to confirm the popular feeling in their behalf. For speed and security, they stand unrivalled; there is but one further improvement requisite, the diminution of the cost of construction, and of management, to confirm the universal preference awarded them. To this all important subject too much of the attention of Engineers cannot be directed. The stimulus to internal improvement, and to private enterprise by Railroads, has received its principal check from unanticipated expenditures. The splendor of a road may gratify the eye, but those who build, and have to sustain them, will calculate the cost, and it must be ever held in mind, that the expense of freight and passage must vary with, and bear a relation to the capital involved in the construction. As you diminish both, the power to cheapen transportation is enlarged, and thus a perference for Railroads in the community, will be extended and confirmed.

These representations of what has been done in the south, of what is in progress, and of whnt remains to be accomplished, must forcibly impress all how dependent these avenues of intercommunication for success, must be on each other. Whatever may be the opinions now in conflict on this

subject, however, local jealousies may for a time engender most mistaken rivalship, yet more liberal and enlightened views, must bring all the stockholders, and managers of Railroads, to the same common ground; that like the veins, and arteries of the human, they are in the physical and commercial world, but parts of one system, the circulation on the one, depended on, and contributing to the circulation on all. The cities of the south and west, can never in justice be jealous of each other's prosperity. They are relatively dependennt on each other, and should that connection by railways with the Tennessee river be consummated, as it no doubt will, there will be a stream of south-western trade and travel, not a subject of strife, between sister cities and roads, but of most abundant participation for all. The inquiry, in the overflowings will be, not who has too little, but who desires more. Can this be deemed extravagant with the facts, which the history of the past affords. When three such cities, as New York, Philadelphia and Baltimore, without including in the exhibit stars of a smaller magnitude, revolving in the same sphere, and by the same impetus power, all within a circle of two hundred miles, and numbering more than half a million of inhabitants, have grown, and continue to increase, and gather strength from the contributions of that mighty empire west, which like a giant, has sprung from its cradle. When a fourth and no less popular city, at the very eastern extremity of the Union, is now pressing forward with its great Railroad, not to *intercept*, but to participate in this trade, more than enough for all. Can the cities of the south doubt, that while neither can appropriate to itself, they may all enjoy, and in abundance, their fair share in the division if they but unite in the means, where union is necessary to its accomplishment. If the North River Canal, the works of improvements in Pennsylvania and Maryland, have already been so influential in encouraging a western trade with the cities of the north and middle States, what may we not confidently calculate upon, when the waters of the Mississippi, are made to flow, as it were, by a shorter and more natural channel, and on a parallel of latitude not to be impeded by the snows, or congealed by the ice of winter. Commerce is not local, and abhors monopoly full as much as nature does a vacuum. It may for a time be paralzed by ill advised restrictions, but in the alasticity of its nature, it will seek avenues of circulation, however impeded and however circuitous. Give it, however, facilities, clip not its wings, and with the speed of the locomotive, it will find its way, in every direction, and apportion to each section of the world, its fair proportion of the interchanges it encourages. A just comprehension of the relations, and of the mutual dependence of the parts, on a universal system of commercial and extended intercourse, must irresistibly lead to the acknowledgment, that to the freedom of trade, as to the liberty of action, must we look for the stimuli to great enterprises.

Impulse has been given by the independent action of States and corporations in every direction, and it is now only necessary to harmonise, and to combine, and to concentrate the energies of each, free from the repulsive spirit of supposed, or mistaken rivalship, to accomplish the ends all aim at.

Respectfully submitted by

JAMES GADSDEN, President, &c.

American Copper.—We are gratified to learn from a late number of the Wisconsin Enquirer, that Messrs. W. Alford and P. W. Thomas of New Baltimore in that territory, have met with complete success in their experiment on smelting copper ore. They constructed a very simple furnace which cost only ten dollars, in which they smelted on the 28th of Sep-

tember last, 2,500 pounds of ore, from which they obtained nearly 700 pounds of good pig copper, pronounced, by competent judges, to be superior to the South American pig copper. The time occupied in procuring from the ore the above amount of copper, was only nine hours. Neither Mr. Alford nor Mr. Thomas had had any experience in the business of smelting, and the result is justly deemed a matter of great consequence to that Territory, which abounds in rich copper ore.

We import over three millions worth of copper annually, which we hope ere long to obtain from our own mines, while we export largely this valuable metal.

RAILROADS IN THE UNITED STATES. By Chevalier De Gerstner.

RAILROADS IN ALABAMA, LOUISIANA, MISSISSIPPI, TENNESSEE, AND KENTUCKY.

(Continued from page 301.

The railroads in these five States also pass more or less through sections of country very thinly settled, and are with some exceptions of a less substantial construction, and with the limited means of the companies, the time of their completion may yet be far distant.

The railroads undertaken in *Alabama* appear very extensive, if the small population of this State be taken into consideration. Only one of the lines, however, that from Decatur to Tuscumbia, has been opened.

The railroads in *Louisiana* are all very short, with the exception of the New Orleans and Nashville railroad; they nearly all terminate at some point on the Mississippi river, and like the railroads in the adjoining State of Mississippi, from lateral branches to this great highway of the west. To some of the railroad companies in Louisiana, loans were granted by the State, while others have obtained bank charters.

In *Mississippi* the railroads are constructed at a considerable expense by companies with banking privileges. The longest line is that from Natchez to Canton.

Two railroads are in progress in the State of *Tennessee*, but no part of them has yet been opened; and in *Kentucky* only 32 miles of railroads are in operation. In the latter State a considerable sum has been expended for the improvement of rivers, turnpike roads, and the Louisville and Portland canal.

The railroads in *Alabama* and *Louisiana* have not an uniform width of track; on most, however, it is 4 feet $8\frac{1}{2}$ inches. The New Orleans and Nashville railroad has a clear width of 5 feet 6 inches. The width of track of the railroads in *Mississippi* is 4 feet 10 inches.

It appears that there are 27 railroads in the above five States, of which only 195 miles are completed and in operation, while their total length, when finished, will be 1148 miles. 33 locomotive engines are used upon 195 miles of roads, which gives one engine for 6 miles; the greatest number of locomotives is upon the Ponchartrain railroad, that is, 5 for $7\frac{1}{2}$ miles, or 1 for $1\frac{1}{2}$ miles of road.

Of the total cost of the railroads, which will be $19,234,000, one-half has already been expended, and only one-sixth of the whole length is in operation. This shows that the works on many railroads must have been suspended, when they were already far progressed. The average cost of the railroads in these five States will be $16,750 per mile, which does not differ much from the cost of the railroads in Virginia, North and South Carolina, Georgia, and Florida

RAILROADS COMPLETED AND IN PROGRESS IN ALABAMA, LOUISIANA, MISSISSIPPI, TENNESSEE, AND KENTUCKY.

No.	Name of Railroad.	From and to where	Opened. Year.	Opened. Miles.	No. of miles. Besides graded.	No. of miles. Not yet constr'd.	Total length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion	Total cost of road.	Cost per mile.
1	Montg'y & West Point,	Montgomery to West Point.			65	20	85	plates $2\frac{1}{2}\times\frac{5}{8}$		200,000	700,000	900,000	10,590
2	Wetumpka and Coosa,	Wetumpka to Fort Williams.			35	21	56	"		50,000	566,000	616,000	11,000
3	Selma and Tennessee,	Selma to Gunters' Landing.			27	143	170			80,000	1,570,000	2,650,080	9,700
4	Cahawha and Marion,	Cahawba to Marion.			27		27			50,000			
5	Linden and Demopolis,	Linden to Demopolis.			10	12	22			25,000			
6	Mobile and Cedar Point,	Mobile to Cedar Point.	1837	5	4	$17\frac{1}{2}$	$26\frac{1}{2}$	" $2\times\frac{5}{8}$	1 locomot.	117,000	183,000	300,000	11,320
7	Tuscumbia, Courtland and Decatur,	Decatur to Tuscumbia,		46			46		2 "				
1	Pontchartrain,	N. Orleans to Lake Pontch.	1831	$4\frac{1}{2}$			$4\frac{1}{2}$	24&56 lbs.	4 "	356,000		356,000	79,110
2	N. Orleans & Nashville,	N. Orleans to Miss. State line.	1839	$22\frac{1}{2}$		66	$88\frac{1}{2}$	$3\times1\frac{5}{8}$	3 "	970,000	800,000	1,770,000	20,000
3	Bath,	New Orleans & Nashville R. R. to Lake.	1837	$1\frac{1}{2}$	2	$2\frac{3}{4}$	6	$2\times\frac{3}{8}$	horses	50,000			
4	Carrolton,	New Orleans to Carrolton.	1837	$7\frac{1}{4}$			$7\frac{1}{4}$	$2\frac{1}{2}\times\frac{3}{4}$	5 locomot's	500,000		500,000	68,965
5	Orleans Street,	In New Orleans.		$1\frac{1}{2}$			$1\frac{1}{2}$	$2\times\frac{1}{2}$	horses				
6	Lake Borgne,	New Orleans to Lake Borgne.	1838	5		20	25	$3\times1\frac{5}{8}$	1 locomot.				
7	Alexand'a & Cheneville,	Alexandria to Cheneville.	1839	6	10	14	30		2 "				
8	Baton Rouge & Clinton,	Baton Rouge to Clinton,				30	30			16,000			
9	Clinton & Port Hudson,	Port Hudson to Clinton and Jackson.	1839	14	14		28	$2\frac{1}{2}\times\frac{7}{8}$	3 "	400,000	100,000	500,000	17,857
10	West Feliciana,*	Bayou Sara to Woodville.			20	8	28	$2\frac{1}{4}\times\frac{5}{8}$	2 "				
1	Mississippi,	Natchez to Canton.	1839	25	15	100	140	40 lbs.	4 "	1,550,000	19,50,000	3,500,000	25,000

* 7 1-2 miles of this railroad are in the State of Mississippi.

RAILROADS IN ALABAMA, LOUISIANA, MISSISSIPPI, TENNESSEE, AND KENTUCKY.—CONTINUED.

No.	Name of railroad.	From and to where.	Opened. Year.	Opened. Miles.	No. of Miles. Besides graded.	No. of Miles. Not yet contr'd.	Totol length of road.	Weight or dimensions of iron rails or bars	Motive power used.	Amount of capital already expended.	Amount wanted for completion.	Total cost of road.	Cost per mile.
2	Vicksburg and Jackson,	Vicksburg to Jackson.	1839	25	20		45	42 lbs	4 locomot's	1,600,000	160,000	1,760,000	39,111
3	Jackson and Brandon,	Jackson to Brandon.			12		12			30,000			
4	Raymond,	Vicksburg R. R. to Raymond.			6		6	$2 \times \frac{5}{8}$		30,000	20,000	50,000	8,333
5	Grand Gulf &Pt. Gibson	Grand Gulf to Port Gibson.			7	$\frac{1}{2}$	$7\frac{1}{4}$	50 lbs.					
1	Hiwasse,	Knoxville to Georgia S'te line.			70	27	97						
2	Lagrange and Memphis,	Lagrange to Memphis.			40	10	50	$2\frac{1}{2} \times \frac{5}{8}$					
3	Somerville Branch,	Lagrange & Memphis R. R. to Sommerville.			10	$3\frac{1}{2}$	$13\frac{1}{2}$	$2\frac{1}{2} \times \frac{5}{8}$		200,000	300,000	500,000	7,874
1	Lexington and Ohio,	Lexington to Portland.	1835	$30\frac{1}{2}$	27	37	$94\frac{1}{2}$	$2\frac{1}{4} \times \frac{5}{8}$	2 locomot's	935,000	1,250,000	21,85,000	23,122
2	Portage.	Bowling Green to Barren riv.	1837	$1\frac{1}{2}$			$1\frac{1}{2}$	$2\frac{1}{4} \times \frac{5}{8}$	horses	12,000		12,000	8,000
27				195	421	$532\frac{1}{4}$	$1148\frac{1}{4}$		33 locomot's				

This statement does not contain the cost of every railroad in progress, and the amount which has already been expended, because of some it was difficult to obtain correct data, on account of the lines being located in remote parts of the States, while others have yet made very little progress, and their ultimate cost is therefore hardly known. In the following table, which contains the aggregates for each State, the deficiencies were made up by estimates founded upon a knowledge of the nature of the works and their plan of construction.

Name of State.	No of railroads	No. miles in operation.	Total length of road	No. of locomotives.	Am't of capital expended.	Am't necessary for completion.	Total cost of railroads.	Average cost per mile.
Alabama,	7	51	$432\frac{1}{2}$ miles	3	$1,222,000	$3,434,000	$4,656,000	$10,763
Louisiana,	10	62	$248\frac{3}{4}$ "	20	2,862,000	1,834,000	4.696,000	18,880
Mississippi,	5	50	$210\frac{1}{2}$ "	8	3,490,000	2,240,000	5,730,000	27,221
Tennessee,	3		$160\frac{1}{2}$ "		1,100,000	855,000	1,955,000	12,180
Kentucky,	2	32	96 "	2	947,000	1,250,000	2,197,000	22,885
	27	195	$1148\frac{1}{4}$ miles	33	$9,621,000	$9,613,000	$19,234,000	$16,750

MESSRS. EDITORS—*The progressive increase of traffic on railways*, is presented in the following report, which must claim the attention of your readers and should inspire capitalists with confidence in this class of investment. *Celerity and certainty of arrival*, will, in all countries, claim the preference, and in none is it more clearly exemplified than in the United States. If we are correctly informed, the steamboats on lake Erie have rapidly increased, and at extra prices, are taking a large portion of the trade and trafic from the sail vessels. The same results took place on the Hudson by the introduction of vessels towed by steam. May we not expect on the land from railways, and the improved locomotive, a like result? We think so. All experience at home, and abroad tend to convince us, that railways are destined to superceed canals, in high latitudes, in the transportation of merchandize, and valuable produce. J. E. B.

From Baron Charles Dupin's Report on the Paris and Orleans Railway.—Experience has proved both in France and abroad, that in a short space of time the facility, expedition, and economy afforded by railways more than doubles the number of passengers and the quantity of merchandise.

In order to support such statements, we will quote the following facts relative to the railways of Belgium, England, and Scotland in positions of extreme difference, and giving rise to a variation in the returns which far exceeded all anticipation.

Comparison of the number of travellers conveyed daily throughout the whole or a portion of the line.

Railways.	Before the establishment.	After the establishment.
Manchester and Liverpool	400	1,620
Stockton and Darlington,	130	630
Newcastle and Carlisle,	90	500
Arbroath and Forfar,	20	200
Brussels and Antwerp,	200	3,000

Increase of the number of passengers by the establishment of a railway.

Liverpool and Manchester,	300 per cent.
Stockton and Darlington,	380 per cent.
Newcastle and Carlisle,	455 per cent.
Arbroath and Forfar,	900 per cent.
Brussels and Antwerp,	1,400 per cent.

Thus, even taking as a criterion the road on which the proportional increase is least of all, we still find that the number of passengers will increase, not only 100 but 300 per cent. The transport of merchandise will experience a similarly rapid increase. We may judge of this by the progress which has been made in *the conveyance of merchandise in French steam vessels, a conveyance of much greater expense than by railway.*

Progress in the conveyance of Merchandise by Railway compared to that of Passengers.

Years.	Passengers.	Tons.
1834	924,063	22,909
1836	1,248,552	161,501
1838	1,535,189	274,808

Thus, while the number of passengers has increased 60 per cent. in four years, in the same time the quantity of goods increased 1,100 per cent.

We are indebted to Mr. P. P. F. De Grand for a number of interesting items of Railroad statistics.

Low Fares, and Low Rates of Freight, Increase the Net Revenue of Railroads.—This is found to be the case, on every Railroad, where the trial has been made, in Great Britain, France and Belgium. Such is the result of searching inquiry, instituted by the French and other governments, and by the large and highly respectable parliamentary committee in England.

Increase of Passengers, by Lowering the Fare.—Extract from the official report of Edmund Teisserenc, (charged by the French government, with the duty of making a study of the railways in Great Britain) to the Minister of Public Works.

"I have before me the statements which were issued as a basis for the subscriptions to the English railways. I find at that time (before the railways were built) the number of passengers was:—

Between New Castle and Carlisle,	per annum,	5,102
Between Liverpool and Manchester,	"	164,250
Between London and Birmingham,	"	488,382

The railway between New Castle and Carlisle, has reduced the fare to one-third of the old fare and the number of passengers has increased 900 per cent.

"The railway between Liverpool and Manchester has reduced the fare one-half, and the number of passengers has increased 200 per cent.

"The railway between London and Birmingham, has left the price about the same, and the number of passengers has increased only 10 per cent.

The above official report is published in the February number of the Journal for Public Works, published in Paris, by a Society of Civil Engineers. It shows the wonderful effects of low fares, in creating travelling. It furnishes the following statistical result:

Fare reduced 66 per cent.	Passengers increased	900 per cent.
Fare reduced 50 per cent.	Passengers increased	200 per cent.
Fare not reduced,	Passengers increased	10 per cent.

Boston Evening Gazette, Nov 7.

Railways—Great Dividends.—Extract from a late official report, on English railways, made to the French Government, by Edward Teisserenc, its agent, charged with the special duty of making a study of these railways:

"The Darlington railway has produced, by its low rate of passage and of freight, a complete revolution, in the region of country which it traverses. It has increased the value of land 100 or 200 per cent. By these low rates, the freight, estimated at 80,000 tons, has been increased to 640,000 tons—the passengers, estimated at 4,000, have been increased to 200,000.

The above extract will be found p. 80 of the February 1840 number of the Journal of Public Works, published in Paris, by a Society of Civil Egineers.

N. B. The following extract, relating to the same railway, is from the 2d Report of the Railway Committee to the British Parliament, p. 189:

"Question 4476. What dividends have you paid? Answer: The original dividends were 4*l*. They rose to 6*l*. per share, and afterwards to 11*l*. The last two years, they have been 14*l*. per share, subject to reserve of 4*l*. dividend, as a sinking fund.

Question 4477. On a share of 100*l*? Answer: Yes.

Question 4478. All your shares are 100*l.* shares? Answer: Yes.

Question 4480. What is the present value of a share? Answer: 260*l.* was the last sale in the market.

The Company charge, on coal exported (as per p. 188 and 189, questions 4457, 4465, 4468, and 4471) 1d per ton, per mile, less 15 per cent. and charge 6d per ton for ascending and descending the inclined plain, less 15 per cent.; or, only 2d for descending inclined plain, and also 2d per ton for wharfage and putting on board the vessel.

They charge (as per p. 400) per passenger, since May 1, 1838, as follows:

1st class, 1 1-2d per mile, equal to 3 cents per mile.

2d class, 1d per mile, equal to two cents per mile.

3d class, 1-2d per mile, equal to 1 cent per mile.

For the 1st 3 months of 1838 and for 1839, we find the following result (as per p. 400.)

1839—Fare, at the above prices, for 53,361 passengers, 1,622*l.* 5s. 9d.

1838—Fare, (1 cent per mile higher than above, on the 1st and 2d classes,) for 32,628 passengers, 1,273*l.* 2s. 7d.

The above charges, for freight on coal, are equal to $2 per ton of 2240lbs. for 100 miles, including the use of stationary engine, the wharfage, and putting the coal on board the vessel.—*Boston Traveller, Nov.* 6.

Low Fares in Public Conveyances and at Taverns.—We have received from a friend the subjoined statement on the effect of making the fares on railroads and public conveyances as low as may conveniently be done. This is only one among innumerable examples in respect to public conveyances where the same result has followed; and the cheaper the fare the greater has been the profit. There is a point, to be sure, below which one would not think of going; but the great mass of every community, embracing about seven-eights of them, are obliged to calculate very closely as to what they can afford; and will be induced to travel when the fares are very light, when they would never think of doing it while fares are high, or considered high. This applies especially to short distances. We have no doubt whatever that if, for eight months in the year, the fare from Boston to Salem was twenty-five instead of fifty cents, from Boston to Lowell fifty cents instead of a dollar, from Boston to Worcester one dollar, instead of one dollar and fifty cents, and from Boston to Providence one dollar, the travel on every one of these routes would be quadrupled. We saw a proposition a few days since, from a gentleman whose authority is entitled to great respect, to raise the fare from Boston to New York to, and to fix it permanently at six dollars, instead of five. For those who travel undoubtedly the fewer passengers the more comfort; but for the profit of the companies, no measure could be more ill-judged. We have no doubt, for six months in a year, if they would carry passengers from Boston to New York for three dollars instead of six, and this might be easily and safely done in boats which should make the whole passage by daylight, the receipts of the company would be double what they would be at six dollars. The same remark applies likewise to public houses. If at the stage dinner houses, for example, the dinner was charged at twenty-five cents, and this in most places can be well afforded, scarcely a passenger would fail to dine. Now the price being fifty cents, not one passenger in six takes any dinner. This may be seen on Railroads. In travelling from Boston to Springfield, at Framingham, at Worcester and at Warren, there is an almost universal rush to the tables, even with passengers who having breakfasted in Boston, to get a lunch or refreshments, which they do, often times, at great personal inconvenience, for 12½ or 25 cents. If the

breakfast or dinner were half a dollar, though it might be even much better than it is, not one in ten would think of taking it. So it is in stage coaches, as every man who travels much, may soon discover, if he will but make careful observation of the case. A few weeks since, where we were travelling in a stage coach with six passengers, two only took breakfast at the stopping place; the other four remaining in the stage, simply because they would not pay fifty cents for a breakfast, which they knew in that place was about four times its actual cost, or because the could not afford it. They avowed the charge for the meal to be the reason why they would not partake of it; and if you could come at the truth in other cases, in a great majority of them this would be found to be the true cause of their abstinence.

Ulster Railway—(8 miles.)

(*From the Fifth Report to the British Parliament on Railways—p.* 428.)

1st class, 17,931 passengers at 1 1-2d., equal to 3 cents per mile,		895*l.*
2d class, 166,690 passengers, at 3-4d., equal to 1 1-2 cent. per mile,		4,167
Together, 184,621 passengers,		5,062*l.*

It is thus very clear that more than four-fifths of the revenue from passengers comes from those who pay 1 1-2 cent. per mile.—*Boston New England Farmer, Nov.* 18.

Edinburg and Dalkeith Railway—Eight and a Quarter Miles.—From Fifth Report to the British Parliament on Railways, page 339 to 343. Receipts for passengers for nine months ending January 31, 1840.

For first class, 1 3-4 per mile, equal to 2 1-2 cents per mile.

1839.	May, 278 passengers,	11	11	8
	June, 432 "	18	00	0
	July, 261 "	10	17	6
	Aug. 347 "	14	9	2
	Sept. 250 "	10	8	4
	Oct. 184 "	7	13	4
	Nov. 178 "	7	8	4
	Dec. discontinued for want of passengers,	00	0	0
Together	1930 at 2 1-2 cts. per mile,	80*l*	8	4

Receipts for the said period for passengers 2nd class 1 1-20d. per mile, equal to 2 1-10 cents per mile.

1839	May, 21,987 passengers,	610	7	5
	June, 26,714 "	720	4	8
	July, 30,041 "	753	5	9
	Aug. 34,468 "	880	12	6
	Sept. 22,461 "	578	12	0
	Oct. 18,299 "	494	17	10
	Nov. 21,129 "	581	9	9
	Dec. 12,290 "	334	7	3
1840	Jan. 14,734 "	403	8	9
Together	202,223 " at 2 1-10th	5,357*l.*	5	11

It will thus be perceived, that nearly the whole revenue of the road was derived from passengers paying 2 1-10th cents per mile; and that the revenue from passengers taxed higher, was so trifling, that their class was discontinued.

During the year 1838, the fare was 1st class 1 1-8d per mile. 2d class 7-8d per mile.

During the year 1839, the fare raised to 1st class 1 1-4d per mile. 2d class 1 1-20d per mile.

Number of passengers 1838—299,201 at the original fare.
do. do 1839—249,066 at the increased fare.

Loss of pass. by the higher fare 50,135 besides the annual increase, natural to this and all other Railroads.

Belgian Railroads.—From Michel Chevalier's very valuable work on the internal improvements of the U. S. &c., published in Paris and in London. Vol.. 1. p. 379:

THE FARES, on the Belgian Railroads were, at the very outset, placed *extremely low.* Instead of an increase of 4 to 1, as had been the case on many lines the INCREASE of passengers, between Brussels and Antwerp, was 15 to 1. But at the end of 1838, the sections then most recently opened being but little productive, the administration became alarmed and *the fares were raised on the 20th Feb,* 1839, still leaving them however at very low rates. *The immediate effect of this rise of fares was to diminish the number of passengers to such a degree that the revenue was less than at the original fares.* Without waiting any longer, the administration, judging itself sufficiently enlightened, tried, in the month of July 1839 a new experiment. It doubled the number of trains upon all the lines and divided them in two classes—one class (the quick trains) stopping only at stations of the first order and the other class (the slower trains) stopping more frequently and going at the same speed as the quick trains, from which speed must be deducted the time lost, by the more frequent stops. It kept up the rate of fares of the 20th February 1839, for the quick trains. But, for the slower trains, it came down, to the original fares. This modification instantly lifted up the receipts to an amount above that at which it stood before raising the fares.—*Boston Evening Gazette, of Nov.* 14.

Garnkirk and Glasgow Railway, (opened at the end of 1831.) [From the Railway Times, of Febuary 22, 1840.]

	No. of passen's.	Receipt for passen's.	Total Recipts.
1832	72,605	1,717*l*	6,476*l.*
1833	96,003	2,440	7,254
1834	117,743	2,985	8,413
1835	136,724	3,438	9,311
1836	145,703	3,850	10,324
1837	119,460	3,803	11,839

By the above, it will be perceived that there is, every year, a regular progress onward (until 1836 inclusive) as regards the number of passengers, the receipts from said passengers, and the total receipts. It will also be perceived that the total receipts still moved onward in 1837.

The question naturally arises, what was it that arrested, in 1837, the onward march in the number of passengers, and in the receipts of said pasengers? We find the problem solved by the Fifth Report to the British Parliament, page 233. The reason is there stated to be that "the fare was raised 33 1-3d per cent., in the beginning of 1837, without any diminution of the expense of running the road."—*Boston Transcript, of Nov.* 6.

Dundee and Arbroath Railway.—Opened 16 miles, June1, 1839. Receipts for passengers for 7 months, ending 30th April, 1840;—1st class—

10,713 passengers, at 2d. per mile, equal to 4 cents per mile, 668*l.* 18s. 7d; 2d class—14,870 passengers, at 1 1-2d per mile, equal to 3 cents per mile, 1,148*l.* 7s. 2d; 3d class—61,876 passengers, at 1d per mile, equal to 2 cents per mile, 2,221*l.* 10s. 5d.

The above is to be found p. 323 of 5th report to British Parliament, and shows that three-fourths of the passengers, giving more than half the revenue, paid only 2 cents per mile.—*Boston Courier of Nov.* 14.

London and Greenwich Railway.—We find by the Monthly Chronicle, Boston, Sept. 1840, page 330, that the Greenwich Railway was opened to Deptford, Dec. 14, 1837, 3 miles, and through the whole length to Greenwich, Dec. 24, 1838. We also find (pages 378 and 379 of the 5th British Parliamentary Report) that this whole length to Greenwich is 3¾ miles. It is therefore very natural that the income of 1839, for 3¾ miles, should be more than the income of 1838, for 3 miles. When asked by the Parliamentary Committee, whether they have raised or lowered their fare, there reply is (see p. 379) as follows:—

"Since the Greenwich Railway has been opened, the whole distance to Greenwich, which took place in Dec. 1838, the fares have been without alteration."

It follows clearly from these premises, that *the opponents of low fares are in error*, when they produce, as *an argument for high fares*, the statement "that the London and Greenwich Railway passengers paid for 11 months of 1838, at 6d, 35,770*l.* and for 11 months of 1839, at 8d, 42,247*l.*

Surely nothing can be more natural than to find a road of 3¾ miles, charge higher for 3¾ miles than it did for 3 miles. Nothing can be more natural than to find 3¾ miles, in 1839, produce more receipts than 3 miles in 1838.—*Boston Morning Post, of Nov.* 16.

Eastern Counties Railway—open 10¼ miles. Receipts for passengers for 8 months, ending 31st January, 1840:

1st class, at 3d per mile, equal to 6 cents per mile, 10,574 passengers,	1,087*l.*	0 6
2d class, at 1 4-5d per mile, equal to 3 3-5 cents per mile, 66,954 passengers,	3,678	5 6
3d class, at 1 1-4d per mile, equal to 2 1-2 cents per mile, 104,508 passengers,	4,003	44 9

The above is from the 5th Report to the British Parliament, by the Select Committee on Railways, page 337. It shows how trifling is the number of travelers who elect to pay the first class price —*Boston Mercantile Journal, of Nov.* 14.

Loss of Money by Raising the Fare, and Gain of Money by Lowering the Fare.—From the official report of Edmund Teisserenc, to the Minister of Public Works in Paris, dated 15th June, 1839, and published in Paris. Pp. 345, 348 and 349.

Belgian Railroads.—Mean receipts per day, for each section :—

1838.—March,	859 francs.	
April,	950 do.	At the original fare.
May,	1,010 do.	
Together,	2819 francs at the original fare.	
1839.—March,	700 francs.	
April,	900 do.	After raising the fare about 40 per cent.
May,	950 do.	
Together,	2550 francs, after raising the fare.	

It stands, then, before raising the fare,	2819 francs.
And after raising the fare,	2500 do.
Loss of receipts, by the higher fare, on each section, per day,	319 francs.

Saint Germain Railroad (near Paris.)

	No. of passengers.	Receipts.
1838.—Jan., Feb., and March, at the original fare,	160,542	172,515 francs.
1839.—Jan., Feb., and March, at fare reduced 25 per cent.,	236,889	189,545 do.
Thus presenting, by the lower fare, a gain, for 3 months, of	76,347 passengers	and 17,030 francs. in the receipts.

Recapitulation.—The *increase* of 40 per cent. *in the fare*, on the Belgian Railroads, gave *a loss* of 11 per cent. *in the receipts.*

The *reduction* of 25 per cent, *in the fare*, on the St. Germain Railroad, gave *a gain* of 10 per cent., *in the receipts.*

By p. 655 of the above named official report, it will be seen that in regard to the Belgian Railroads, the Belgian Administration, *perceiving the loss of receipts by the rise of fare, have gone back to the original rates*, (which is equal to 4-5th of one cent per mile, for the 4th class passengers) for the trains which have been established to land and take up passengers, every three or four miles. And *Michel Chevallier*, (in his valuable work on Railroads, Canals, &c., published in Paris and London in 1840) mentions, vol. i. p. 379, *that thus lowering the fares* on the Belgian Railroad, "*instantly carried the receipts up*, to an amount *exceeding* that at which said receipts stood before raising the fares."—*Boston Atlas, of Nov.* 17.

Railways in the West.—Great as are now our locomotive appliances, they were found during the races altogether inadequate to the demand. On Thursday, the number on the joint line of railway to Glasgow amounted to 6,500, but that number might have been doubled had there been a sufficiency of carriages. Yesterday, more effective arrangements appear to have been made. There were 25 trains up and 25 down, and the number of passengers amounted to 8,200, while several thousands were disappointed. The pressure of passengers last night was tremendous; hats, and still more, ladies' bonnets, and other articles of dress, were terribly crushed, and one woman had her leg broken. Besides the passengers on the joint line, there were from 3,000 to 4,000 on the line from Ayr. At many of the hours of starting of the canal boats more was left than taken; but we cannot state the numbers, as they are not made up over night. On Thursday the number of passengers by the Renfrew railway amounted to 2,800; but yesterday vast numbers left for the water places, as well as for Glasgow, and not less than 36 trains ran, conveying nearly 6,000. The Paisley steamer started each day also, and was well patronised, having conveyed yesterday about 130 passengers up the Gareloch.—*Paisley Advertiser*,

Railroad Iron.—A London letter says: "Orders from America for railroad rails of manufactured iron, have, during the past week, been given out to the iron trade to the enormous weight of 35,000 tons; and it is anticipated when this contract is completed, others will speedily follow, though not to the present extent."

It gives us pain to see so much American money sent to England to purchase an article which is so abundant in this country as that of iron. If our own rich and exhaustless mines were adequately worked, it would furnish a great additional, and a quite reliable market for our large surplus agricultural products. We call upon our western farmers to speak out up-

on the momentous subject of providing a sure home market for the products of their industry. The condition of all foreign nations is such, that they must necessarily raise a large annual revenue to meet the interests on vast public debts, and for the support of expensive systems of government, by assessing a heavy duty on nearly all foreign products consumed by the people of those countries.

They are compelled to resort to this indirect mode of raising money, and cannot, if they desired so to do, abandon the policy of taxing our bread stuffs for the support of their oppressive monarchical, aristocratical systems. Nothing short of a total revolution, and the general refusal to pay the interest on their national debts, can enable the principal governments of Europe to adopt the much praised system of free trade. Unless the people of this Republic choose to submit to an enormous tax, without any equivalent, amounting at this time to more than two dollars on every barrel of flour sent to England to pay for railroad iron, they must meet this tax by a countervailing duty upon the products of English labor.

Whatever the price of American bread-stuffs to be shipped abroad may be reduced in value in our Atlantic cities, in consequence of the duty imposed upon them by foreign governments, such duty is to that extent a direct tax imposed upon the productive industry of this country, for the support of the Kings, Queens and Emperors of Europe. Mark well the fact, that the price of wheat and flour at all times when we have a surplus in Boston, New York, Philadelphia, and Baltimore, is governed by its value to ship to foreign countries; and that its value to ship depends in a good degree on the duty assessed upon it in foreign ports. Let no one who is not tory enough to submit to a tax for the payment of the national debt of Great Britain, and for the support of her majesty, and the established church of England, acquiesce in the impositon of a duty on the products of American industry in British ports, without a corresponding duty on the products of British labor in American ports, for the *protection* and *encouragement* of home production.

The Propeller Steamboat.—This vessel was built in the yard of Mr. Dichburn, at Blackwall. The engine by which her paddles, or propellers, as they are termed, are worked, was made by Mr. Beale, the engineer, at his premises at Greenwich. She is a small vessel, but very elegant in her proportions, and formed to cut through the water with great rapidity. The engine is of 24 horse power. The propellers differ from the paddle-wheels used by other steamers, in being single blades of iron, only one blade on each side of the vessel, and not a series of blades brought into the water by the revolution of wheels. Each blade is very broad and large, and dips almost perpendicularly in the water, so that the concussion formed by the blades of paddle-wheels dipping into the water at angles is avoided, and the consequent unpleasant vibration of the vessel.

Directly the blade dips into the water it is forced back by an arm or limb of iron, forming a motion similar to the leg and web-foot of an aquatic bird, and by means of this motion the vessel is propelled forward. She can perform from 10 to 11 knots, or miles, an hour. The appearance of the propellers is like that of the legs of a grasshopper, and when in motion their action, in some degree, resembles the legs of that insect in its walk. One great advantage is, that the propellers occasion no swell in the water, no wake or trough in the river, and no backwater, so that no danger is occasioned to small boats by the rapidity of her progress. This vessel now runs hourly between Blackwall and Greenwich, and appears to be a great favorite, from the number of passengers she is continually conveying backward and forward between these places.